Hybrid Trucks Users Forum (HTUF):

A National Program to Speed Commercialization of Heavy-Duty Hybrids

Advanced Transportation Technologies

Clean Transportation Solutions SM

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Clean Cities Web Cast
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MISSION STATEMENT

WESTSTART-CALSTART IS DEDICATED TO CREATING AND EXPANDING A GLOBAL ADVANCED TRANSPORTATION TECHNOLOGIES INDUSTRY AND ITS MARKETS THAT WILL:

- Clean the air;
- Increase energy efficiency in transportation; and
- Create high-quality jobs

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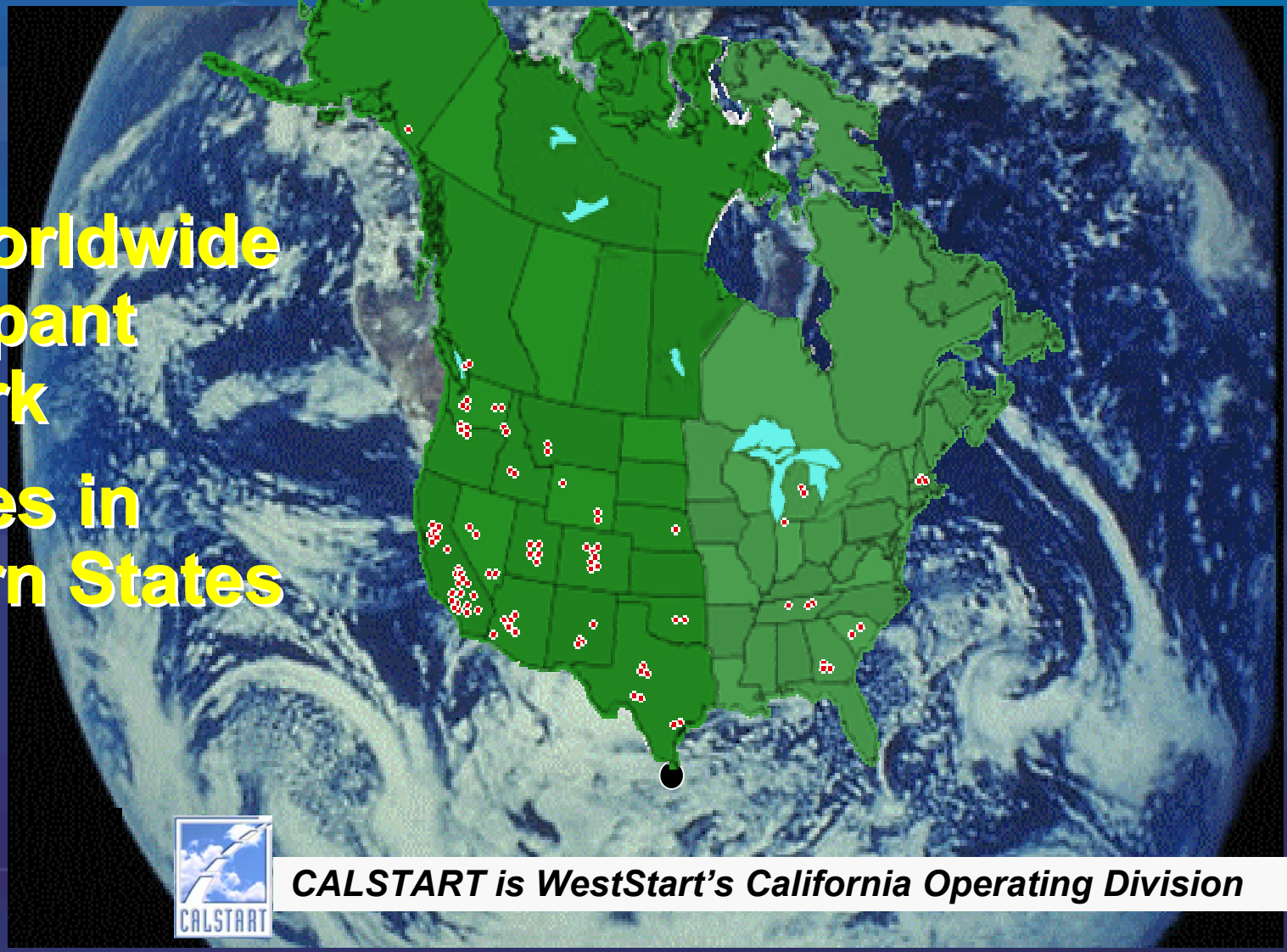
WestStart: A Strategic Broker for Advanced Transportation

2005

120+ Worldwide Participant Network

3 Offices in Western States



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Some Current Trends Impacting Heavy-Duty

- Trucks and equipment have increasing basic electrical needs on board
- Some truck makers already adding secondary electrical systems, larger battery packs, readying move to higher voltage systems
- Idle Management is a growing issue
- Optimizing urban truck drivelines is becoming critical for fuel efficiency, emissions

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U.S. Army Vision

21ST Century Truck Initiative

Trucks are Vital to the Army

Trucks Provide the Logistical Backbone to the Army

Fuel constitutes 70% of bulk tonnage needed to sustain a military force on the battlefield. This equates to about 600,000 gallons per day.

- Fuel Efficient AAN Task Force

The US Army has a fleet of over 246,000 tactical wheeled vehicles and drives 823 million miles annually.

Army After 2010 Goal:

"...75% Reduction in Fuel Requirements for a Deployed Force..."

- Hybrid Technology exhibiting
  - 25% Better Fuel Economy
  - Potential of up to 50%
- Hybrids also offer opportunities to
  - Reduce Stateside Emissions
  - Audible Noise through Electric Only Drive
  - Heat Signatures
  - Improved terrain Mobility
  - Fast Launch technology
  - Elimination of Generator Trailers

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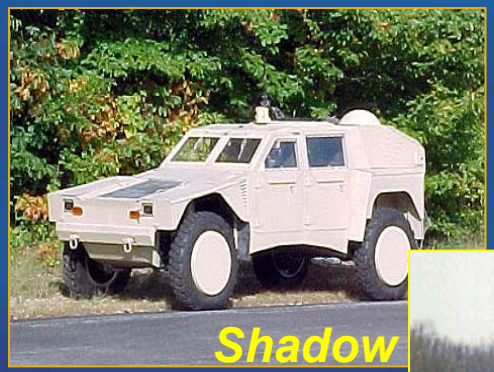
Hybrid Platforms Are Being Tested

- Multiple military platforms moving forward
- All help advance hybrid drivelines
- Multiple hybrid “flavors”
  - Hybrid electric; Hybrid hydraulic
- FMTV, HMMWV, HEMMT of most interest to commercial users for capability
- NAC now launching FTTS – Future Tactical Truck Systems – focus is light platform (10,000+ GVRW) and med/heavy platform



Shadow Hybrid RST-V

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Hybrid Electric Propulsion Technology Benefits

Military Benefits

- 25% - 50% Better Fuel Economy
- Flexible Electrical Power Generation
- Reduced Signature (Stealth Mode)
- Improved Performance
- Reduced Maintenance (brakes, transmission)
- Uses Standard Fuels
- Similar to Today's Vehicles

Commercial Benefits

- Reduced Emissions (up to 90%)
- 25% - 50% Better Fuel Economy
- Improved Driveability, Quieter
- Improved Performance
- Reduced Maintenance (brakes, transmission)
- Uses Standard Fuels
- Similar to Today's Vehicles

Technology that Benefits Military and Commercial Markets

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Hybrid Truck Users Forum (HTUF)

- Joint WestStart/US Army National Automotive Center (NAC) effort to expand commercial market for heavy-duty hybrid vehicles
- Link commercial needs with military development to drive down cost, increase volumes

- Forum proceeding through stages of:
  - education/outreach
  - familiarization
  - specification and business case development
  - commitment/ deployment

- Forum now in specification development stage, moving toward pre-production purchase commitments

NAC

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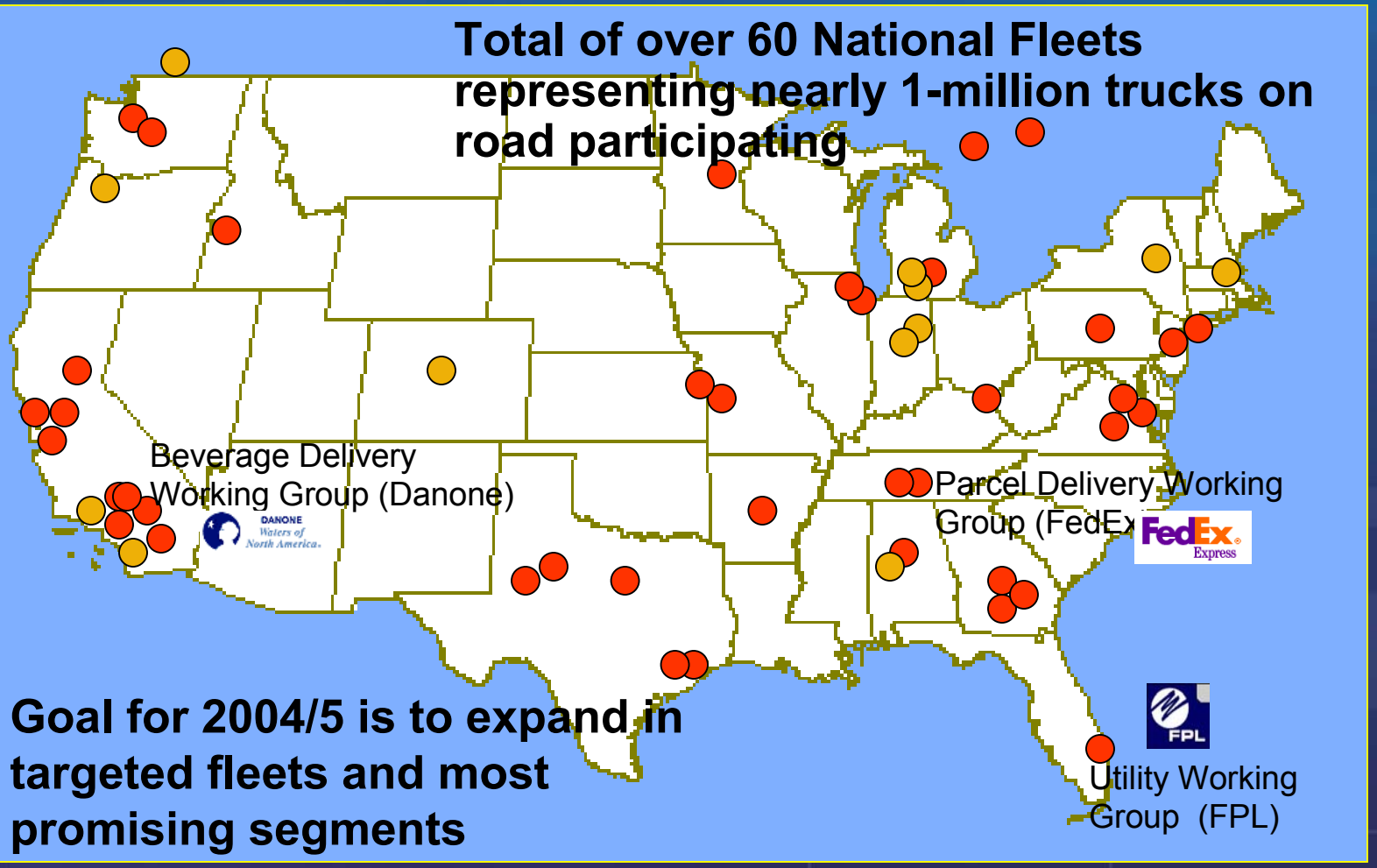
H-TUF: A National Program Continues to Expand

Selected OEM/ Supplier locations shown

Selected fleet locations shown



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Hybrid Truck Users Forum Meeting: Kalamazoo 2004

- 250 fleet and industry attendees (45% increase over 2003)
- 14 hybrid medium- and heavy-duty trucks in ride and drive

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Beverage Company

- Coca Cola Sacramento
- Danone Waters
- Perrier (Nestles Water Group)
- Pepsico/Frito-Lay
- Yosemite Waters

Refuse

- Waste Management
- Los Angeles Dept of General Services
- New York City Sanitation
- Houston Sanitation

Government Agency

- Canadian Army
- General Services Administration
- Idaho National Energy labs
- San Joaquin Valley Clean Cities
- United States Army
- United States Army Aviation
- United States Air Force

Parcel/Mail Delivery

- FedEx Express
- FedEx Ground
- United Parcel Service
- United States Postal Service
- DHL Worldwide Express
- Purolator Courier

Less Than Load & Regional Delivery and Line Haul

- American Trucking Association (TMC)
- Ryder Transportation Services
- Schneider National
- Wal-Mart Transportation
- Enterprise Truck Rental
- GE Fleet Services

Grocery Chain

- Safeway/Vons
- Kroger

University

- Indiana University Motor pool

Power Company/Utilities (over 25)

- Alabama Power
- AEP
- Baltimore Gas & Electric
- Duke Energy
- Electric Power Research Institute
- Florida Power and Light
- Illinois Power
- New York Power Authority
- Pacific Gas and Electric
- Southern California Edison
- Tennessee Valley Authority
- Memphis Light Gas and Water
- Georgia Power
- Gulf Power
- Los Angeles Dept of Water and Power
- Sacramento Municipal Utility District
- TXU

H-TUF Member Fleets

(partial list)

Focus Area for H-TUF: Top Early Hybrid Applications

Class 7/8 Refuse trucks

Class 3-6 Urban delivery trucks

-package delivery

-beverage delivery

Specialty Truck Applications (Class 4-6)

-Utility "Bucket" trucks

-Telecom/cable trucks

-Fire/rescue trucks

Class 6-8 Heavy Urban delivery trucks

-regional heavy distribution (beverage, grocery, postal)

H-TUF Working Groups

- User-focused effort led by fleets
- 4 Working Groups of fleet truck users operating; two forming (refuse trucks, transit)
  - **Utility/Specialty trucks – George Survant, Florida Power & Light, lead**
  - **Parcel Delivery trucks – Sid Gooch, Fed Ex Express, lead**
  - **Beverage Delivery/Heavy Regional trucks – Frank Guercio, Danone Waters NA, lead**
  - **Hybrid Ground Service Equipment (GSE) – User lead TBD**
  - **Refuse Working Group (forming)**
  - **Hybrid Transit Bus (forming)**

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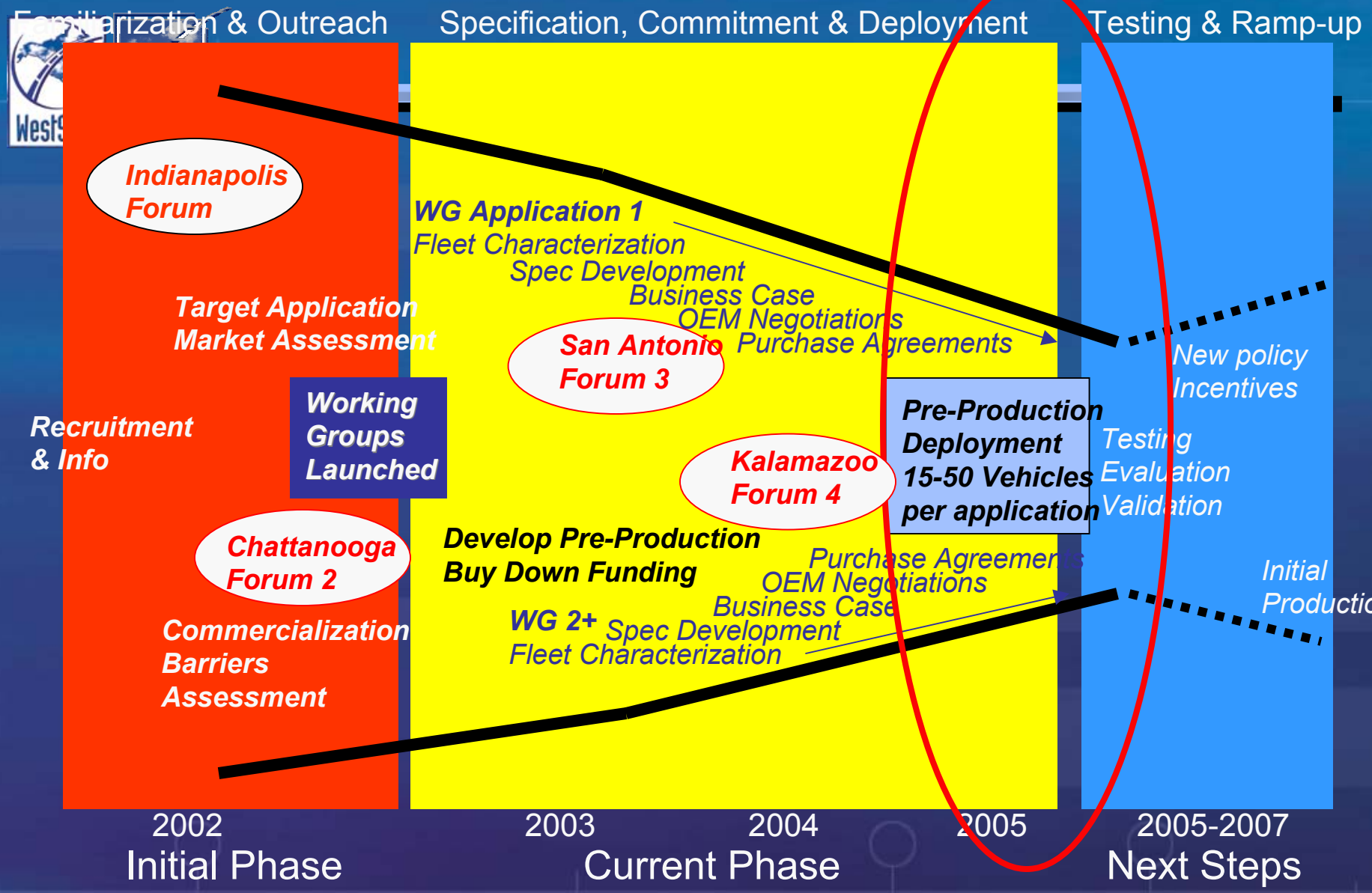
H-TUF "Commercialization Funnel"



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Just Announced: Hybrid Electric Utility Trouble Truck

Class 6/7
Hybrid Electric
40-60% Fuel Economy Improvement
Greatly Improved Total Emissions
Idle Reduction (shuts off at work site)
25 kW power export
Meets or exceeds driving performance requirements
20+ pre-production trucks to be built and assessed

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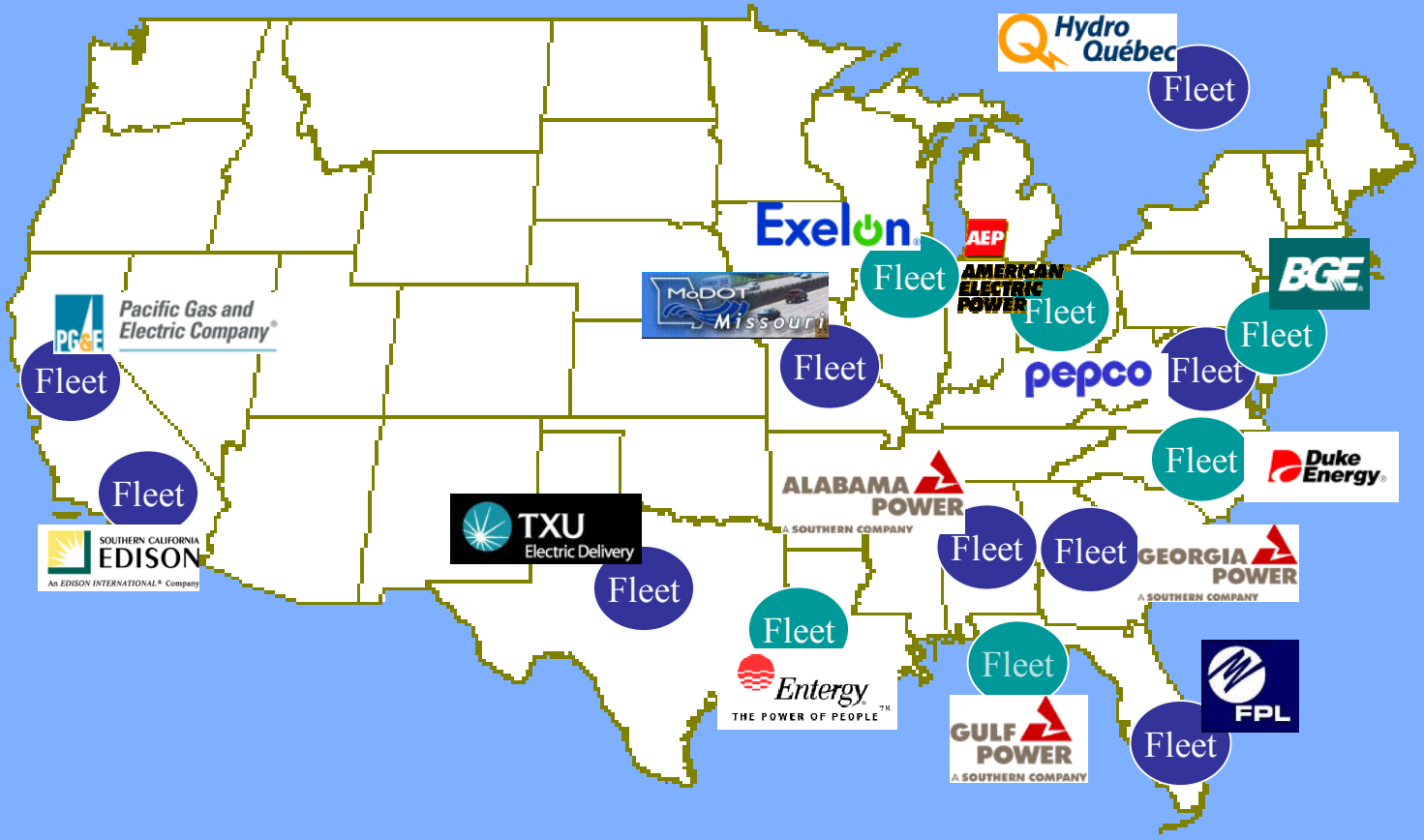
Utility Hybrid Truck Fleet Deployment

Fleet
Original RFP Task Force

Fleet
Fleets Wanting to Join the RFP



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Performance Requirements for Fleets – Are We Meeting Them?

- Maintain base vehicle dimensions and core functionality
  - 65 mph top speed; Able to merge with freeway traffic
  - No decreased payload capacity
  - Able to tow trailer
- Transparent to user from vehicle and lift perspective
  - Hydraulic power for lift/tools
- Reliability equal to or exceeds baseline vehicle
  - Measured by cost to maintain/mean time to failure

No change in frame

25-30% improvement

Small weight gain

Better performance

No change in user interface

Meet or exceed – builds on base of existing components

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Fleet Requirements

continued

- Significant increase in fuel economy
  - 50% increase desired
- Reduce emissions over diesel
  - Meet or exceed 2010 requirements
- Overall life-cycle costs less than or equal to diesel
- Reduced noise levels compared to diesel
  - Operate at work sites on stored energy
- Generate field power
  - 25 kW output –

40-60%+ fuel economy gains expected!

To be determined: Up to 50% reduction over current truck expected

Meet/exceed Considering fuel savings and benefits

Idle reduction – average 2 hours without engine

120/240 V power, 5 kW and 25 kW

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H-TUF – Entering Initial Buy-Down Phase

- CALSTART has raised $1+-million in federal DOD funding for H-TUF partial "buy-down" of incremental cost of commercial path pre-production trucks – nationwide
  - Will be matched by several million ($4-5M) investment from Working Group participants
- Teaming with different state and regional funds to extend reach of program
- $5.5-7M in federal and private sector funding

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H-TUF Summary

- HTUF assisting the largest commercial deployments of hybrid trucks in nation
- HTUF commercial hybrid trucks match the size and powertrain requirements of Army platforms – helping speed commercialization and lower overall costs (leveraging investments)
- Goal is 20-60 commercial path hybrids deployed by end 2005- including hybrid utility trouble trucks deploying to fleets nationwide in early 2005 – and deployments of hybrid urban and regional delivery trucks, specifications for refuse trucks and GSE
- Rigorous emission, performance and business case evaluation for 2005
- Hybrid electric and hybrid hydraulic platforms

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What Does HTUF Need?

- **More Fleets Always Wanted to Participate!**
- Working Groups continue to expand, new ones form
- Good opportunity to:
  - Learn
  - Share information
  - Shape commercial offerings
  - Be involved in early deployments

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